

What is claimed is:

1. A method for determining the emission rate of a selected test gas emitted in the exhaust gas of a gas-fueled engine, the method comprising the steps of:
 - (A) measuring the relative concentration of a test gas in the exhaust gas;
 - (B) measuring each of fuel-gas flowrate, fuel-gas temperature and fuel-gas pressure;
 - (C) computing a volumetric flowrate of the exhaust gas from the fuel-gas flowrate, temperature and pressure measurements; and
 - (D) computing a test gas emission rate from the calculated volumetric flowrate of the exhaust gas and measurement of relative concentration of the test gas;wherein steps C and D, are performed in real time by a suitably-programmed digital computer.
2. The method of claim 1, further comprising the step of sending the computed test gas emission rate to a display device.
3. The method of claim 1, wherein the steps of the method are repeated at a selected time interval a selected number of times so as to calculate a series of test gas emission test data.
4. The method of claim 3, further comprising the step of sending the measurements to a computer-readable database for subsequent preparation of a formal emission report.
5. The method of claim 1, further comprising the steps of:
 - (A) obtaining from a computer-readable database:
 - (i) a measurement of the ambient pressure;

(ii) an instantaneous compressibility factor for the fuel gas;

(iii) a gross calorific value for the fuel gas; and

(iv) a dry fuel F factor for the fuel gas; and

(B) measuring the relative concentration of O₂ in the exhaust gas;

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wherein, the step of computing a volumetric flowrate of the exhaust gas from the fuel-gas flowrate, temperature and pressure measurements, includes using the measurements of ambient pressure; instantaneous compressibility factor for the fuel gas; gross calorific value for the fuel gas; dry fuel F factor for the fuel gas; and relative concentration of O₂ in the exhaust gas, to calculate the volumetric flowrate of the exhaust gas.

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6. The method of claim 1, further comprising the step of obtaining a fuel-gas flowrate measurement conversion factor; and wherein the step of computing a volumetric flowrate of the exhaust gas from the fuel-gas flowrate, temperature and pressure measurements, includes using the fuel-gas flowrate measurement conversion factor to calculate the volumetric flowrate of the exhaust gas.

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7. The method of claim 1 for use with an engine having an intake manifold, the method further comprising the steps of:

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(A) measuring in real time each of intake manifold temperature and intake manifold pressure;

(B) determining the engine load from the measurements of intake manifold temperature and intake manifold pressure, and an engine load curve; and

(C) calculating in real time an emission rate per engine load using the computed test gas emission rate and the engine load.

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8. The method of claim 7, further comprising the steps of:

(A) obtaining engine data from a computer-readable database; and

(B) selecting an appropriate engine load curve from a plurality of engine load curves based on the engine data.

9. A method for determining the emission rate of a selected test gas emitted in the exhaust gas of a gas-fueled engine, the method comprising the steps of:

(A) obtaining:

- (i) a measurement of the ambient pressure;
- (ii) an instantaneous compressibility factor for the fuel gas;
- (iii) a gross calorific value for the fuel gas; and
- (iv) a dry fuel F factor for the fuel gas;

(B) receiving real-time measurements of the:

- (i) relative concentration of the test gas in the exhaust gas;
- (ii) relative concentration of O₂ in the exhaust gas;
- (iii) flow rate of the fuel gas;
- (iv) temperature of the fuel gas; and
- (v) pressure of the fuel gas;

(C) calculating in real time a dry volumetric flow rate of the fuel gas from the flow rate of the fuel gas, the fuel-gas temperature, the fuel-gas pressure, the ambient pressure and the instantaneous compressibility factor of the fuel gas;

(D) calculating in real time the volumetric flow rate of the exhaust gas from the dry volumetric flow rate of the fuel gas, the dry fuel F factor, the gross calorific value of the fuel gas and the relative concentration of O₂ in the exhaust gas;

(E) calculating in real time the emission rate of the test gas from the relative concentration of the test gas in the exhaust gas and the volumetric flow rate of the exhaust gas; and

(F) sending, in real time, the calculated emission rate of the test gas to a display device;

wherein the steps are performed by a suitably-programmed digital computer.

- 5 10. The method of claim 9, wherein the computer obtains the measurement of ambient pressure; instantaneous compressibility factor for the fuel gas; gross calorific value for the fuel gas; and dry fuel F factor for the fuel gas, from a computer-readable database.
- 10 11. The method of claim 10, wherein the computer receives the measurements of relative concentration of the test gas in the exhaust gas; relative concentration of O₂ in the exhaust gas; flowrate of the fuel gas; temperature of the fuel gas; and pressure of the fuel gas, from a data collection buffer that collects the relative concentrations of the test gas and O₂ from a gas analyzer; collects the flow rate of the fuel gas from a fuel gas flowmeter; collects the fuel gas temperature from a temperature sensor located proximate to the fuel gas flowmeter; collects the fuel gas pressure from a pressure sensor located proximate to the fuel gas flowmeter; formats this collected data into a form suitable for the computer; and sends this formatted data to the computer.
- 15 12. A method for determining the emission rate of a selected test gas emitted in the exhaust gas of a gas-fueled engine having an intake manifold, the method comprising the steps of:
- 20 (A) measuring the relative concentration of the test gas in the exhaust gas;
- (B) measuring each of fuel-gas flowrate, fuel-gas temperature and fuel-gas pressure;
- 25 (C) measuring each of intake manifold temperature and intake manifold pressure;
- (D) calculating a volumetric flowrate of the exhaust gas using the measurements of the fuel-gas flowrate, temperature and pressure;

(E) calculating a test gas emission rate using the calculated volumetric flowrate of the exhaust gas and the measurement of the relative concentration of the test gas;

(F) determining engine load from a load curve using the intake manifold temperature and intake manifold pressure measurements; and

(G) calculating an emission rate per engine load using the calculated emission rate of the test gas and the engine load;

wherein steps D, E, F and G, are performed in real time by a suitably-programmed digital computer.

13. The method of claim 12, further comprising the steps of:

(A) obtaining engine data from a computer-readable database; and

(B) selecting an appropriate engine load curve from a plurality of engine load curves based on the engine data.